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TRACKING NONLINEAR OBJECT AND IT'S PARAMETER

PANDHARINATH A. GHONGE & KUSHAL TUCKLEY

Department of Electronics Engineering, Ramrao Adik Inst of Technology, Navi Mumbai, Maharashtra, India

ABSTRACT

A kalman filter as predictor for moving target devolved to detect & parameters like velocity, acceleration and displacement tracked. The approaches of target detection using barker code length with autocorrelation decide sharpness. The parameters of tacking target are predicted. At each epoch time average the sum of Diagonal element of covariance matrix for innovation is computed and compared with the dynamic ballistic missile. If the difference is high than predetermined level, the scale factor is set to update. Some computer result is carried out to compare the performance Kalman filter.

KEYWORDS: Radar Target Identification, Additive Noise, State Measurement

INTRODUCTION

Radar posse's unique and valuable attributes, there are some factors that can render information incomplete (03). The structure for the theory of Radar Target Identification (RTID).Radar signal processing consists of digital pulse compression using Barker code of sufficient length detect target. SNR estimation and ECM features like improving SNR in hostile environment (04). The approach is to estimate process noise variance by means of scale factor (04) (05). and, tracking algorithm using Kalman filter nonlinear target like ballistic and reentry space vehicles are presented. The simulation result demonstrates that the Kalgan filter is most robust to the sudden changes of the target.

Target Detection

The pulse compression correlates the receive signal to a delayed copy of that which was transmitted Barker sequences are unique with specific length can contains absolute values, 0, 1, for N bits in the sequence. and thus yield the best resolution for a given transmitted bandwidth (04) (05 that allowing secure enciphering Bits increases S/N ratio increases.

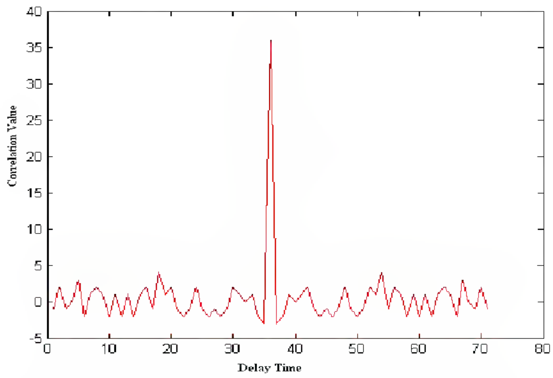

Figure 1: Autocorrelation of One of the 35- Bits

Tracking System

Tracking is the process whereby the radar follows the position of one or more objects in space, are only samples for every few seconds, with no knowledge of target maneuvering between scans (04) (08). Two types of tracking radars that can provide the tracks of targets, (TWS) and Full track adar. as shown in Figure 2.

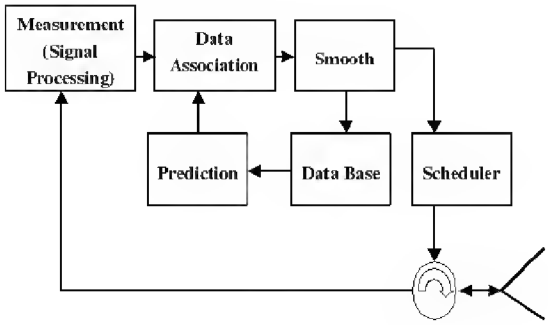

Figure 2: Tracking Mechanism

The Kalman Filtering The Kaman filter used is recursive. Considering with states $x_1(k) = p(k)$ for the range and $x_2(k) = \dot{p}(k)$ for the radial velocity, the state with bearing $x_3(k) = \theta(k)$ and bearing rate (angular velocity) $x_3(k) = \theta(k)$ the addition of this two state arguments equation.T times radial and angular acceleration (06), (07). Algorithm for tracking (k+1) We denote this one-step prediction estimate as x(k+1)|k By 'the predictor that minimizes the mean-square error prediction error m the minimization of the mean-square prediction error the correction term consist of the exact difference between the new data samples y(k) and previous prediction estimate cx(k|k-1(03),(04).

Predictor equation:

$$\hat{x}(k+1|k)=ax(k|k-1)+\beta(k)[y(k)-cx(k|k-1)] \quad (1)$$

$$\beta(k)=acp(k|k-1)[c^2p(k|k-1)+\sigma^2_v]^{-1}$$

Prediction mean-square error:

$$p(k+1|k)=a^2p((k|k-1)-ac\beta(k)p(k|k-1)+\sigma^2_w \quad (2)$$

The filter will monitor its own performance and adapt parameters when a maneuver is detected. Recursive equations of Kalman filter are given below:

$$X[n/n-1]=X[n-1/n-1]+v, \quad (3)$$

$$P[n/n-1]=FP[n-1/n-1]FT+Q, \quad (4)$$

$$Z[n/n-1]=HX[n/n-1]+w, \quad (5)$$

$$K = PHT\ (HPHT + R)-1,$$

$$X[n/n]=X[n/n-]+K(Z[n]-HX[n/n-1]), \quad (6)$$

$$P[n/n]=(I-KH)P[n/n-1]. \quad (7)$$

Where X - State Variable, F - State transition matrix (System dynamics (process) model), H - Measurement transition matrix, P - State estimate error covariance, K - Kalman gain based on MMSE, Z - State measurement, v,w - Process model noise and Measurement noise respectively

Constant Velocity Model

Then number of states which represent dynamics are position and velocity. The discrete state transition equation s given low:

$$\begin{bmatrix} x[n] \\ x_v[n] \end{bmatrix} = \begin{bmatrix} 0 & T \\ 0 & 1 \end{bmatrix} \begin{bmatrix} x[n-1] \\ x_v[n-1] \end{bmatrix}.$$

Constant Acceleration Model

Then number of states which represent dynamics are position, velocity and acceleration. The discrete state transition equation

$$\begin{bmatrix} x[n] \\ x_v[n] \\ x_a[n] \end{bmatrix} = \begin{bmatrix} 1 & T & T^2/2 \\ 0 & 1 & T \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x[n-1] \\ x_v[n-1] \\ x_a[n-1] \end{bmatrix}.$$

T is sampling period of the target by radar.(.8),(09) The simulation parameters are shown

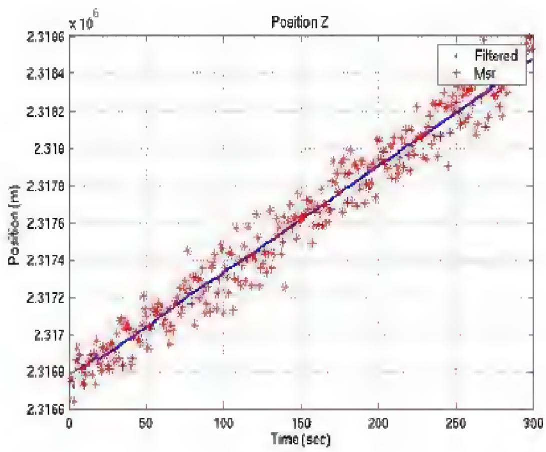

Figure 3: Measurement and Filter Position in Z Axis

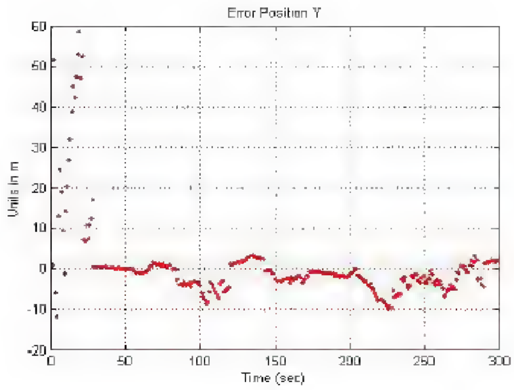

Figure 4: Measurement and Filter Position Error in Y Axis of Aircraft by K

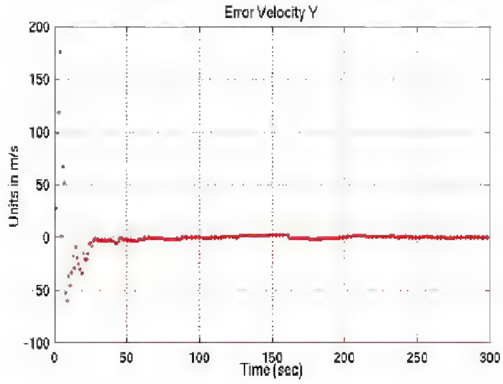

Figure 5: Measurement and Filter Error Velocity in Y axis of Aircraft by KF

CONCLUSIONS

Bi-phase Barker coding sequences are unique in that their autocorrelation sequence. The Kaman filter used is recursive filter so far means the estimation of the current value of a random signal in the presence of additive noise, depending on how many steps of unit time ahead we want to predict. Measurement filter error are more at initial states while tracking position velocity and it is optimum later because of sampling theory later it is more linear.

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